The Concept of
BAMBI

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# International BAMBI Users

(September 1st, 1978)

<table>
<thead>
<tr>
<th>Region</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Amerika</td>
<td>72</td>
</tr>
<tr>
<td>West Europe</td>
<td>71</td>
</tr>
<tr>
<td>Far East</td>
<td>13</td>
</tr>
<tr>
<td>East Europe</td>
<td>6</td>
</tr>
<tr>
<td>Various</td>
<td>6</td>
</tr>
</tbody>
</table>

**TOTAL** 168
INTERNATIONAL BAMBI USERS
(September 1st, 1987)

- Various (3.6%)
- East Europe (3.6%)
- Far East (7.7%)
- North Amerika (42.9%)
- West Europe (42.3%)
Goals for BAMBI

• Flexibility
  
  models = physics
  geometry = devices

• Easy-To-Use

• Efficiency

• Get-It-Done
Design Options

• Architecture

• Discretization

• Linearization

• Linear Systems Solver
Design Options

(Architecture)

- Interpreter?
- Compiler?
- Interactive?
- Batch?
- Geometry Interface?
- Model Interface?
- Memory Management?
- Post Processing?
Design Options

(Discretization)

- Finite Differences?
- Terminating Lines?
- Finite Boxes?
- Classical Finite Elements?
- Hybrid Finite Elements?
- Exotic Almost Finite Elements?
- Boundary Value Methods?
Meshes for a Lateral Bipolar Transistor

[Diagrams showing meshes for a lateral bipolar transistor]
"FIELDAY" Mesh

Finite element model of a bipolar transistor.

by: P.E. Cottrell and E.M. Buturla, Proc. NASECODE I
"PISCES" Mesh

Final grid after distortion (793 points).

Doping contours for MOSFET.
"PISCES" Mesh

Initial rectangular grid (874 points).

Rectangular grid after eliminate operation (793 points).
Recessed Gate MESFET Mesh
Recessed Gate MESFET Mesh
(Enlarged Detail)
Design Options

(Linearization)

• Simultaneous Methods?
  
  Approximate Jacobian
  Overshoot

• Block Iterative Methods?
  
  Gummels Method
  Relaxation Methods

• Initial Solution?

• Termination Criteria?
Design Options

(Linear Systems Solver)

• **Factorization Based Methods?**
  - Ordering: Bandwidth Based
  - Ordering: Envelope Based
  - Ordering: Profile Based
  - Ordering: Dissection Based
  - Ordering: Degree Based

• **Iterative Methods?**

• **Semi Implicit Methods?**
Effort Spent

3 person years by Dr. Gerhard Franz

2 person years by Dr. Andrea Franz

2.5 person years by Mr. Wolfgang Kausel

1 person years by Mr. Gerd Nanz

5.5 years elapsed time

4700 MIP-CPU hours
COMPUTER PERFORMANCE (microVAX II units)

- Cray-1: 71.6
- NAS-9160: 28.9
- CDC-180/860: 9.5
- CDC-170/730: 1.8
- CDC-170/720: 1.3
## Our Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donation of DIGITAL</td>
<td>$3_{\mu}VAX$ II</td>
</tr>
<tr>
<td>Donation of Ges.F.Mikroelektronik</td>
<td>$1_{\mu}VAX$ II</td>
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<tr>
<td>Donation of SIEMENS (7531)</td>
<td>$0.25_{\mu}VAX$ II</td>
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<tr>
<td>Central Facilities (NAS-AS9160)</td>
<td>$0.28_{\mu}VAX$ II</td>
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<tr>
<td></td>
<td>7 hours/month, ratio 28.9</td>
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<tr>
<td>Central Facilities (CDC-180/860)</td>
<td>$0.13_{\mu}VAX$ II</td>
</tr>
<tr>
<td></td>
<td>10 hours/month, ratio 9.5</td>
</tr>
<tr>
<td><strong>TOTAL RESOURCES</strong></td>
<td>$4.66_{\mu}VAX$ II</td>
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</tbody>
</table>
Our Work Will Continue

We Need Constructive Feedback

Our Time Constants Are Long